ILLUSTRATED CONCEPTS IN TROPICAL AGRICULTURE

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# CROP QUALITY CONTROL THROUGH SOIL MANAGEMENT TECHNIQUES: MANIPULATING NITROGEN AND WATER TO RIPEN SUGARCANE

**Fig. 1. Sugarcane after nitrogen control at 7, 13, and 20 months.**

There are as many aspects of crop control as there are uses for crops. Quality may be characterized by various attributes, for example, gluten strength in grain, crispness of vegetables, acid content of tomatoes, protein content of forage, or burning properties of tobacco. In simplest terms, quality sugarcane is high in sucrose and low in reducing sugars.

Skilled sugarcane agronomists attempt to maximize both cane yield and quality.

One useful technique for ripening cane is nitrogen control. During the first few months of growth, leaf nitrogen percentage is kept high, promoting rapid leaf canopy development for efficient light interception and weed control. After the canopy is "closed in," nitrogen percentage is allowed to decrease gradually, and the emphasis shifts to stalk development and sugar storage. Older leaves lose some of their dark-green color as nitrogen is translocated to younger leaves. While the photosynthetic rate decreases, the growth rate decreases even more, resulting in a net saving of photosynthate to enhance sugar storage.

Finally, during the months just before harvest, emphasis is placed on converting reducing sugars to sucrose as indicated by greater juice purity. During this "ripening" stage, nitrogen is severely depleted in the leaves. The young leaves become yellow, and the moisture percentage decreases as the plant becomes less succulent. There is little internode development, and old leaves die faster than young leaves are formed; thus, green top, immature cane, and poor juices are minimized.

Water control is used in conjunction with nitrogen control to bring sugarcane to peak quality on irrigated plantations. The irrigation interval is gradually lengthened as the crop advances toward maturity, the objective being the reduction in growth of the plant and the conversion of reducing sugars to sucrose.

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The photographs above and crop data below illustrate the manipulation of nitrogen and water to control sugarcane quality. The fields, all variety 57-3775, were photographed and sampled on the same plantation on the same day. Leaves of young cane were rich in nitrogen, dark green in color, and rapidly forming a dense canopy. Leaf-blade nitrogen levels were somewhat lower than ideal; however, growth was vigorous as indicated by sheath weights (means of sheaths 3, 4, 5, and 6) and high sheath moisture. Sucrose percentage (pol % cane) and purity (sucrose/total solids) of juices were low. Growth in the 13-month-old cane was slowing as leaf nitrogen was decreasing. At this point, juice purity and sucrose percentage of the cane were increasing. Peak quality was being approached in the 20-month-old cane. There were fewer functional leaves, and these were yellow; nitrogen percentage was very low; tops were desiccated; the juice purity and sucrose percentage of the cane had reached acceptable levels. The field was harvested at 24.1 months of age. The ratio of cane to sugar was 7.4 to 1. The sugar yield was 15.5 tons per acre (34.8 tons per metric hectare), or 0.64 ton sugar per acre per month (1.42 tons per hectare per month).

Table 1. Some indicators of sugarcane growth and quality as a function of crop age

| Indicator | Age | | | |
|---|---|---|---|---|
| | 3.5 mos. | 7 mos. | 13 mos. | 20 mos. |
| Sheath weight (g) | 90 | 91 | 82 | 55 |
| Sheath $H_2O$ (%) | 86 | 83 | 83 | 76 |
| Leaf blade N (%) | 2.14 | 1.94 | 1.73 | 0.96 |
| No. of green leaves | – | 13 | 13 | 10 |
| Purity (%) | – | 53.6 | 67.7 | 91.1 |
| Pol % cane | – | 4.8 | 7.7 | 15.6 |

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